INTRODUCTION
Ipsilateral knee pain (IKP) is commonly associated with many intra-articular hip pathologies and other sources of pain referred from the lumbar spine and pelvis area. The purpose of this study was to evaluate the pattern of IKP before and after hip arthroplasty. We hypothesized that hip pathology was one of the causes of preoperative IKP and that it would demonstrate significant improvement after hip arthroplasty.

MATERIALS AND METHODS
This was a retrospective review of prospectively collected complete patient data sets of those who underwent primary and revision total hip arthroplasty (THA), metal-on-metal hip resurfacing (MOMHR) or conversion THA between November 2006 and November 2008. Exclusion criteria included patient refusal to participate, bilateral hip reconstruction, and ipsilateral or contralateral knee replacement within this same time period. Western Ontario McMaster Osteoarthritis Index (WOMAC) pain score was the primary outcome measure, which was prospectively obtained preoperatively, and at 3 months and 1 year postoperatively. Paired t-test and chi-square test were used to evaluate the significance of difference.

RESULTS
Two hundred and fifty five patients were enrolled (all provided data); 245 patients (96.1%) had at least one follow up data at 3 months or 1 year. Preoperatively, 141 of 255 (55.3%) had IKP, which was much higher than contralateral side, (45 of 255: 17.6%), p<0.0001. Also, the IKP score (79.7 ± 26.5) was significantly lower than contralateral side (94.8 ± 14.9), p<0.001. IKP showed marked improvement to 95.7 ± 11.8 and 95.6 ± 12.6 at 3 months and 1 year respectively (p<0.001). When compared to the contralateral knee pain score at 3 months, 95.5 ± 13.7, and 1 year, 95.7 ± 11.6, there was no difference between two knees (p=0.84 and 0.87 respectively).

DISCUSSION
To the best of our knowledge, this is the first investigation that has provided a quantitative assessment of the IKP associated with hip pathology before and after hip arthroplasty.

We conclude from these findings is that IKP is a common phenomenon for patients who have end-stage hip pathology. Our results demonstrate that 55% of our patients preparing for hip arthroplasty had IKP, which was remarkably high compared to the 17.6% (p < 0.0001) for the contralateral knee. One possible explanation of this finding is that OA in the ipsilateral knee may play a role. However, in the current study, IKP improved dramatically without any treatment directed to the ipsilateral knee. Thus it seems likely that referred pain from hip pathology plays a central role in the IKP.

Secondly, these findings suggest that perceived IKP significantly improves after hip arthroplasty. While referred IKP has been studied relatively well in the pediatric population, there have only been a few case reports and qualitative studies on adult. Yet as with these reports, all previous studies attempt to demonstrate the pattern of referral pain without quantitatively evaluating IKP before and after hip pathology being treated. Tracking both knee outcomes after hip arthroplasty, our study demonstrates that reported IKP improved, from a baseline 79.7 ± 26.5, to 95.7 ± 11.8 and 95.6 ± 12.6 at 3 months and 1 year respectively (p<0.001) to plateau at a comparable level to the contralateral knee. Fully understanding this phenomenon is critical for clinical practice and patient care.

Diagnosing and treating patients with concurrent hip pathology and knee pain can be difficult. Not only do a majority of patients with hip OA report preoperative ipsilateral knee pain, but thirty to forty percent of patients suffering from knee OA have concomitant hip OA. To further complicate diagnosis, many patients have symptoms of hip and knee OA early in its course without radiographic changes and 40% of patients with typical radiographic changes may be asymptomatic. In all such cases, diagnosis and treatment can be challenging. We recommend that careful physical and radiographic evaluations should be done for both hip and knee joints when examining hip or knee OA patients. If the symptoms can be explained by hip pathology, strong consideration should be given to treating the hip pathology first with careful follow up on the ipsilateral knee after surgery. If a diagnostic conundrum exists, intra-articular local anesthetic injection should be considered. In most cases described in the present study, perceived IKP improved significantly after hip surgery without any specific treatment of the knee.

CONCLUSION
Evaluation of joint specific functional data showed a direct correlation between hip pathology and concurrent IKP. Additionally, we observed a dramatic improvement in patient perception of IKP after hip arthroplasty and patients attained a pain level commensurate to the contralateral side.

Table 1: WOMAC Pain Scores of Bilateral Hips and Knees before and after hip arthroplasty

<table>
<thead>
<tr>
<th></th>
<th>Ipsilateral knee</th>
<th>Contralateral knee</th>
<th>OR hip</th>
<th>Contralateral hip</th>
</tr>
</thead>
<tbody>
<tr>
<td>Preop</td>
<td>91.0 ± 25.3</td>
<td>95.19 ± 13.5</td>
<td>94.58 ± 23.8</td>
<td>93.40 ± 13.2</td>
</tr>
<tr>
<td>3 months</td>
<td>95.6 ± 11.8</td>
<td>95.48 ± 11.7</td>
<td>93.20 ± 13.7</td>
<td>97.44 ± 45.7</td>
</tr>
<tr>
<td>1 year</td>
<td>95.59 ± 12.6</td>
<td>95.79 ± 11.57</td>
<td>92.37 ± 15.52</td>
<td>93.74 ± 15.35</td>
</tr>
</tbody>
</table>

Figure 1. Percentage of Reported Knee Pain. Figure 2. Joint Specific WOMAC Pain Score Improvement. Blue: preop score; red: 3 month postop score; green: 1 year postop score. 1: Operative hip; 2: Ipsilateral knee; 3: Contralateral knee; 4: Contralateral hip

Figure 3. Difference between IKP and CKP pre-op and 3 mo.s and 1 yr post-op.